UNDERGRADUATE RESEARCH IN NATURAL AND CLINICAL SCIENCE AND TECHNOLOGY (URNCST) JOURNAL
Read more URNCST Journal articles and submit your own today at: https://www.urncst.com

REVIEW OPEN ACCESS

Systematic Review of Quality Improvement Interventions on Surgical Safety Checklists

Lovejeet K. Manger, BHSc Student [1]*, Emma Zhang, BMSc Student [2]

[1] Department of Biochemistry and Biomedical Sciences, McMaster University, Hamilton, Ontario, Canada L8S 4L8
[2] Department of Medical Biophysics, University of Western Ontario, London, Ontario, Canada N6A 3K7

*Corresponding Author: mangel2@mcmaster.ca

Abstract

Introduction: Postoperative mortality is a significant global burden, partially driven by preventable perioperative errors, caused by human factors that contribute to preventable harm. The World Health Organization's Surgical Safety Checklist (SSC) was introduced to reduce preventable harm during surgery and to improve surgical outcomes. Despite it being implemented across many healthcare systems, compliance and effective use of the SSC remains inconsistent. This systematic review aims to synthesize recent evidence on quality improvement interventions (QII) that target SSC implementation, identify strategies, and evaluate their impact on checklist utilization and related outcomes.

Methods: This systematic review was conducted in accordance with the Cochrane Handbook and reported following the PRISMA 2020 guidelines. A literature search was performed using MEDLINE and PsycInfo, which limited the studies to those published between 2015 and 2025. Data was extracted using a standardized form, and study quality was assessed using the Joanna Briggs Institute (JBI) Checklist for Qualitative Research.

Results: 23 studies published between 2015 and 2025 were included in this systematic review. The studies varied in design, sample size, units of analysis, and were conducted across a broad range of surgical specialties. QII included educational and training initiatives, audit and feedback mechanisms, mentorship programs, simulation-based interventions, and the introduction of modified checklist tools. Most interventions targeted all three phases of the SSC. Improved checklist compliance was the most frequently reported outcome. Fewer studies evaluated patient-centered outcomes.

Discussion: The findings indicate that QII are generally effective in improving implementation and the use of the SSC across diverse surgical settings. However, the evidence base is limited by heterogeneity in intervention types, outcome measures, and study designs, with most studies relying on observational or pre-post methodologies. The limited reporting of patient-level outcomes restricts conclusions regarding the direct impact of these interventions on postoperative morbidity and mortality.

Conclusion: Quality improvement interventions are associated with improved implementation and use of the SSC across diverse surgical contexts. While these interventions consistently enhance compliance and team engagement, further high-quality research is needed to determine its impact on patient outcomes and to identify the most effective and sustainable strategies.

Keywords: surgical safety checklist; World Health Organization; quality improvement interventions; perioperative safety; patient safety; checklist compliance; surgery checklists

Introduction

Around 5.7–8.4 million patients are attributed to poor and unsafe surgical care [1]. If a patient survives after the complication, there are also costly postoperative procedures which cause economic burden to both the healthcare system and the patient [2]. Among the major complications, surgical error caused by human factor is the second largest cause, which include factors such as inaccurate judgement, inattention to detail, lack of situational awareness, communication and teamwork errors, and leadership errors [3–4]. To prevent postoperative complications, the World Health Organization (WHO) introduced the Surgical Safety Checklist (SSC) in 2008 [5]. The SSC is a tool to help improve patient safety during surgery with a 19-item checklist using the three key stages of operation: Sign In, Time Out, and Sign Out. 'Sign in', also named briefing, is a checklist prior to induction of anesthesia; 'Time Out' is a checklist prior to skin incision; 'Sign Out' is a checklist prior to patient exiting the operating room [6]. By going through the three key points during surgery, there is a lower risk of patient complication due to reduced errors and improved team communication [7] and statistically significant relative

reduction in mortality and morbidity has been shown, with up to 36% decrease in postoperative complications and similar reduction in death rates [8]. However, after the implementation of SSC, although almost all hospitals acknowledge it, few complied to use this non-mandatory checklist [6]. It was not until 2010 that countries with high Human Development Index (HDI) achieved near complete use of SSC as a mandatory hospital policy. By 2016, surveys and studies have indicated that 70% of global facilities, which include many low- and middle-income countries, were adopting the checklist according to the policy.

Although there has been increased implementation of the SSC and multiple reviews evaluating the outcomes of SSC since after its first implementation, recent quality-improvement and redesign effects remain under-explored. Persistent gaps continue to hinder optimal SSC utilization, including insufficient training and knowledge, limited organizational support within hierarchical team structures, and practical constraints in clinical settings.

A major large-scale study from Ontario, Canada, highlighted an important gap in the area of SSC effectiveness [9]. Despite widespread adoption, the investigators found no significant difference in patient outcomes before and after implementation. This finding stands in contrast to the global expectation that the SSC should reduce operative mortality and complications. Although the WHO emphasizes that hospitals should adapt the SSC to their local culture and workflow, a lack of standardization and limited attention to quality-improvement practices may partly explain the null results. During the large-scale study, outcomes from 133 hospitals were rigorously collected and analyzed over three months before and three months after SSC adoption. Yet even with this robust dataset, there was no statistical reduction in in-hospital or 30-day mortality, complication rates, or surgical compliance measures post-implementation. This outcome serves as a critical reminder: simply introducing the SSC is not enough. Meaningful improvements in surgical safety likely depend on how the checklist is implemented, monitored, and continually refined [9]. These findings underscore the urgent need for renewed focus on implementation fidelity, quality improvement strategies, and context-specific adaptation to realize the full potential of the SSC.

Although hospital leaders and policy makers have implemented SSC to improve healthcare industry, they may not understand the clinical realities of doctors who would eventually use the SSC in real world conditions.

Through a qualitative study, Pourzamani et al. demonstrated that the SSC is not always implemented correctly or consistently, may fail to fully adhere to checklist protocols, thereby compromising patient safety and surgical outcomes [10]. Nofal et al., attempted to address these challenges through educational workshops to improve awareness and compliance of SSC. Nevertheless, the effectiveness of SSC utilization was highly context dependent, relying on prior institutional familiarity and existing knowledge of the SSC [11].

Moreover, the systematic review by Paterson et al. highlighted that hierarchical culture and reluctance of surgeons to share responsibility for checklist completion remain major barriers to effective SSC implementation. This review also identified issues such as duplication of existing safety processes and checklist fatigue, both of which negatively affect SSC compliance [12].

In addition to major barriers, practical limitations such as increased workload, time pressure, competing tasks between staffs, emergency procedures and frequent distractions contribute to the decreased compliance of SSC. Sometimes these limitations might even lead to time out procedures omitted entirely, undermining the purpose of the SSC [12].

Currently, there is a lack of review on quality improvement interventions on the SSC. This review seeks to fill that gap by systematically examining recent evidence on the implementation and effectiveness of SSC related interventions and by identifying various quality improvement interventions. The findings aim to provide a comprehensive understanding of current SSC practices and inform the development of evidence-based policies and strategies to optimize SSC protocols, ultimately enhancing patient and surgical team safety.

Methods

This systematic review was conducted in accordance with the Cochrane Handbook for Systematic Reviews of Interventions and reported according to the updated Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement [13]. The protocol for the review was registered with PROSPERO under the registration number CRD420251162095 (Available at https://www.crd.york.ac.uk/PROSPERO/view/CRD420251162095).

Literature Search

For this review, a literature search was conducted on September 6, 2025, using MEDLINE (1946 to September 5, 2025) and PsycInfo (2002 to September 5, 2025). The search strategy included combinations of MeSH terms related to surgical checklists, operating rooms, and quality improvement. The search was also limited to papers published from 2015–2025.

Inclusion and Exclusion Criteria

Inclusion criteria were (1) quality improvement intervention explicitly explained, (2) one or all three of the SSC pause points are targeted for improvement, (3) SSC compliance, or related quality metrics are the primary outcomes, and (4) SSC are OR-based. There were no restrictions on the data collection methods. Studies that reported SSC as a secondary outcome were also included in this review.

Exclusion criteria were (1) papers that were reviews (any kind), commentaries, editorials, short communications, conference abstracts, or study protocols, (2) studies that solely focused on SSC implementation rather than quality initiatives, (3) SSC used in non-OR settings, (4) non-real world implementation/investigations, (5) non-English full texts, and (6) papers that were outside of a 10-year period (2015–2025).

Data Extraction

Using a preformatted Excel sheet, the following data was extracted from the 23 papers: (1) Author/Publication Year, (2) Number of Participants, (3) Surgical Specialty, (4) Type of Intervention(s), (5) Description of Intervention(s), (6) Targeted Pause Point(s), (7) Outcome Types, (8) Effectiveness, and (9) Additional Comments. E.Z. extracted data from 12 of the papers, L.M. extracted data from the remaining 11 papers, and the extractions were verified by A.T.

Quality Assessment

The quality of the studies included in this systematic review was assessed with the Joanna Briggs Institute (JBI) "Checklist for Qualitative Research". Each study was appraised using a subjective rating of poor, fair or good by the assessors (E.Z.), and verified by A.T.

Results

Search Results

The database search results yielded 677 papers, with 630 papers remaining after removing duplicates. A pair of screeners (E.Z., and L.M.) independently reviewed title/abstracts of the 630 retrieved papers from the search. Any conflicts were resolved by a third screener (A.T.). Out of the 630 papers, 593 were deemed irrelevant after title and abstract screening. 37 papers underwent full text review, out of which 23 were chosen for this systematic review. Figure 1 presents the PRISMA flow diagram outlining the study selection process and search results.

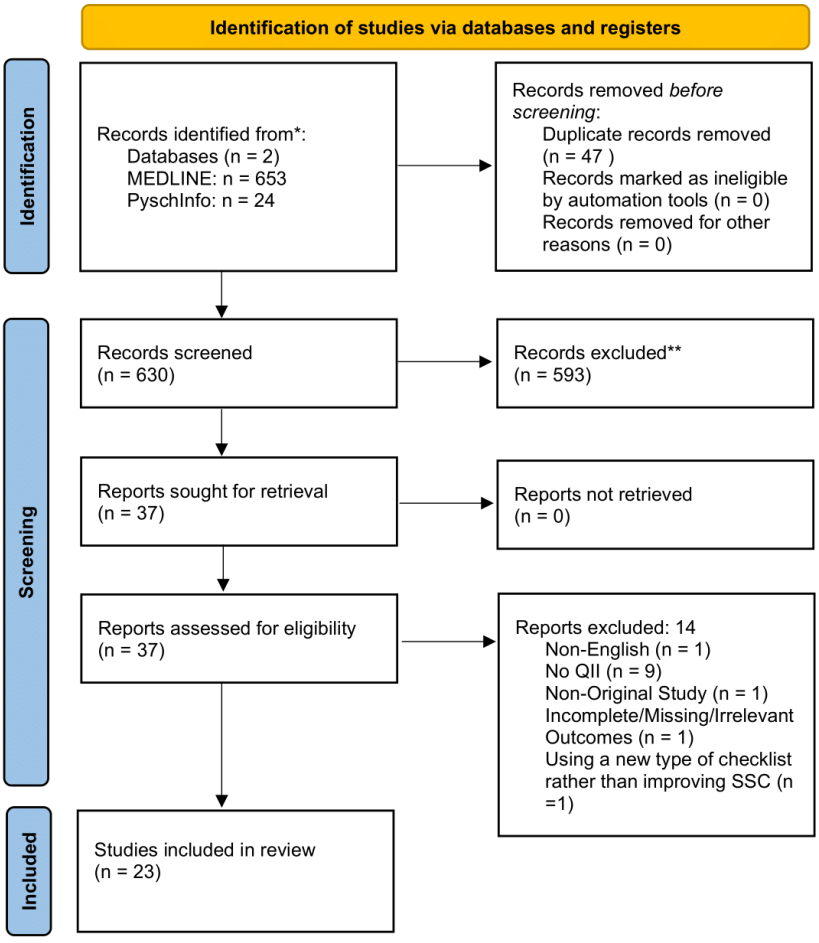

Figure 1. *PRISMA Flow Diagram Generated by Covidence.* Note search results were uploaded to Covidence where the automatic deduplication was performed.

Data Quality

Based on the JBI critical appraisal checklist, the overall data quality of the included studies was generally high. Most studies demonstrated high methodological quality, data collection, analysis, and interpretation, indicating that the research methods were largely appropriate, and aligned with study objectives. There was some variability observed in domains related to the influence of the researcher, ethical approval, and the extent to which conclusions clearly flowed from the data. Despite these concerns, there were many high-quality studies included in this systematic review. Figure 2 presents the critical appraisal of studies 1–23 using the JBI checklist.

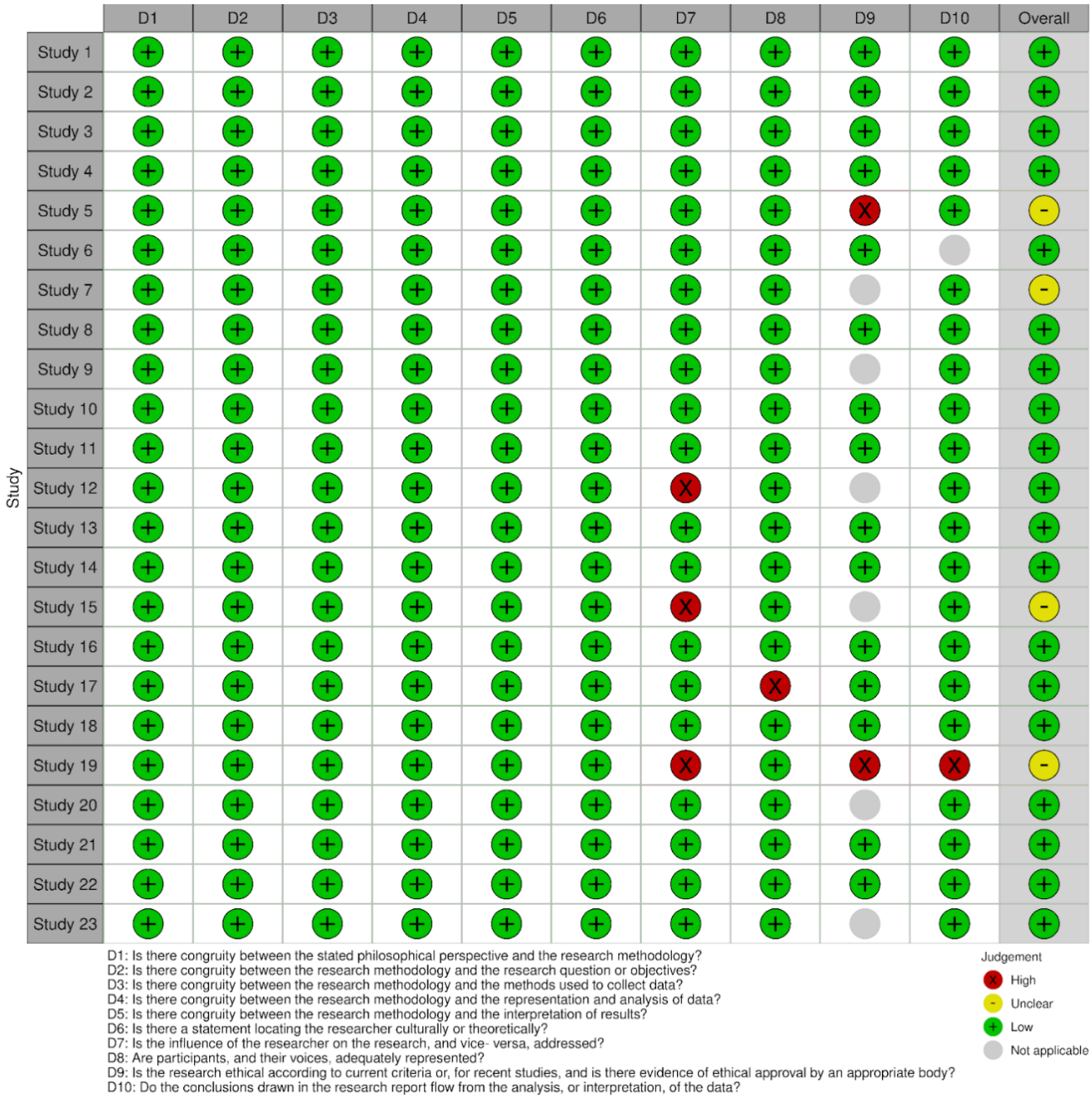

Figure 2. *Critical Appraisal of the Studies. Studies 1 to 23 were assessed using the JBI Critical Appraisal Tool for Qualitative Research.* The appraisal summary was visualized using Risk of Bias Visualization Tool (ROBVIS).

While many included studies reported quantitative outcomes (e.g., compliance rates, audit metrics, pre–post changes), the primary focus of this review was the implementation and process characteristics of quality improvement interventions targeting Surgical Safety Checklist use, rather than causal estimation of intervention effects.

Quality improvement studies frequently employ hybrid designs in which quantitative measures function as indicators of implementation success rather than as outcomes intended for causal inference. Given the predominance of uncontrolled, audit-based, and pre-post designs, traditional quantitative risk-of-bias tools were considered less informative, as they are optimized for evaluating internal validity and effect estimation.

The JBI Checklist for Qualitative Research was therefore applied to assess methodological rigor related to congruence between study aims, intervention design, data collection, contextual transparency, and interpretation, which are central determinants of validity in implementation-focused research. Additionally, substantial heterogeneity in outcome definitions and measurement approaches precluded meaningful comparison or standardization of quantitative metrics across studies.

Study Characteristics and Publication Year

A total of 23 studies were included in this review, with publication years ranging from 2015 to 2025. About half of the studies were published between 2015 and 2016 (11/23, 47.8%), with the remaining studies distributed across subsequent years.

Study Size and Units of Analysis

The number of participants varied across the included studies due to differences in how the study populations were defined. Some of the studies reported sample size in terms of the number of hospitals, operating rooms, or clinical sites where interventions were implemented, while others reported the number of surgical procedures observed, checklists audited, or checklist performances evaluated. The sample sizes ranged from small cohorts of fewer than 50 procedures or participants to large scale audits that involves thousands of surgical cases or checklist observations.

Surgical Specialties and Clinical Settings

The interventions were implemented across a wide range of surgical specialties, included General Surgery, Trauma, Orthopedics, Pediatrics, Ear, Nose and Throat (ENT), Ophthalmology, Gynecology and Obstetrics, Neurosurgery, Urology, Oral and Maxillofacial Surgery, Cardiothoracic Surgery, and Surgical Oncology. Eight studies (8/23, 34.7%) reported implementation across multiple surgical specialties, whereas seven studies (7/23, 30.4%) did not specify the surgical specialty. The remaining studies focused on single specialties, most commonly general surgery or pediatric surgery.

Types of Quality Improvement Interventions

A variety of intervention types were reported across the included studies. These included educational interventions such as training workshops and simulation-based education, mentorship and peer feedback initiatives, audit and feedback mechanisms, implementation of digital, audio assisted, or modified SSC tools, and quality improvement programs that incorporated multiple components. The most common intervention type was the introduction of a new tool or process related to SSC uses, which was reported in 10 of the 23 studies (43.5%).

Surgical Safety Checklist Pause Points Targeted

The interventions targeted different pause points within the SSC, including Sign In, Time Out, and Sign Out. While some studies focused on improving compliance or quality at a specific pause point, most studies (13/23, 56.5%) targeted all three phases of the checklist. Other studies concentrated on individual components.

Outcome Measures and Effectiveness

The outcomes assessed across all the studies varied, and included measures such as checklist compliance, checklist completeness, quality of checklist execution, staff engagement and participation, staff opinions, workflow or process measures, and a few studies also included patient-related outcomes. Improved compliance with SSC use was the most frequently reported outcome, observed in 18 of the 23 studies (78.3%). Several studies reported statistically significant increases in compliance following intervention implementation, while others reported descriptive improvements without formal statistical testing.

Total Scope of Included Studies

Across the 23 studies included, the studies evaluated SSC implementation over a 10-year period, across 33 institutions, 3452 operations, 29 ORs, 3044 checklists, 9825 specimens, and other studies reporting implementation in other ways (pause points, audits, etc.). From a clinical perspective, the studies took place across 11 specialties, where some studies took place in multiple surgical specialties, while some were limited to single specialties. Table 1 summarizes the study characteristics, and Table 2 outlines the extracted outcomes of the quality improvement initiatives. Figure 3 illustrates the distribution and effectiveness of these interventions.

Figure 3. *Distribution and effectiveness of quality improvement interventions.* This figure illustrates the number of occurrences of four common improvement strategies identified across included studies along with their effectiveness (always effective, relatively effective, or not effective). Always effective interventions demonstrated statistically significant improvements. Relatively effective interventions showed improvement in interventions, but changes were not statistically significant. Not effective interventions either showed no improvement or produced worse outcomes. Although there were 23 studies, some studies implemented multiple types of quality improvement strategies, leading to more than 23 total occurrences. The effectiveness rating for always effective was defined as reported with significant improvement. The effectiveness rating for relatively effective was defined as reported with improvement but non-significant. The effectiveness rating for not effective was defined as no to little quality improvement. These significance determinations were determined from the results of the original studies. The figures were created using Microsoft Excel.

Table 1. *Extraction template summary of the study characteristics, including author/publication year, number of participants, and surgical specialty.* The number of participants is reported as described in the original studies and therefore reflects different units of measurement across studies (e.g., number of hospitals, procedures, or checklists evaluated).

Author/Publication Year	Number of Participants	Surgical Specialty
Campbell et al., 2024 [14]	163	Urology, General Surgery, Gynecology & Obstetrics, Cardiothoracic
Krstulovic et al., 2025 [15]	1437 clinical checklist records	General, Trauma & Orthopedics, Pediatric, ENT, Ophthalmology, Gynecology & Obstetrics, Neurosurgery, Urology, Oral and maxillofacial surgery
Badasa et al., 2025 [16]	50 for each cycle	Surgery, Gynaecology & Obstetrics, Orthopaedics, Ophthalmology
Bete et al., 2023 [17]	23 public health facilities	General, Not Specified
Levy et al., 2023 [18]	11 (pre intervention) + 17 (post intervention) = 28	No specific specialty mentioned (stated 'multiple specialties', but said mainly servicing general surgery for the intervention)
Nofal et al., 2023 [11]	1940(pre intervention) + 827(post intervention) = 2767	Obstetrics &Gynaecology, General Surgery, and other sub-speciality
Fridrich et al., 2022 [19]	715 (n=210 Sign In; n=281 Time Out; n=224 Sign Out) feedback n = 565	No specific specialty mentioned
Brown et al., 2021 [20]	around 100 cases per cycle	Not Specified (but mentions a variety of surgical specialties)
Ngonzi et al., 2021 [21]	678 (n=200 pre intervention; n=230 during intervention; n=248 post intervention)	Obstetrics and Anesthesia
Cushley et al., 2021 [22]	97 Sign in and 97 Time Out	General, Orthopaedics, Gynaecology, Urology, ENT theatres
Lagoo et al., 2019 [23]	55	General, Surgical Oncology, Transplant, Trauma
Finch et al., 2019 [24]	27600	Broad Surgical Speciality
Robertson et al., 2015 [25]	106 beds, 6 operating rooms	Orthopaedics
Overdyk et al., 2015 [26]	23 ORs (n=2963 for cases)	No specific specialty mentioned
Rhee et al., 2016 [27]	1610 audits in 6 months At an 1170-bed urban academic medical center	No specific specialty mentioned
Reed et al., 2016 [28]	92 procedures	No specific specialty mentioned
Putnam et al., 2016 [29]	1346 checklist performances observed	Pediatric Surgery
Ong et al., 2015 [30]	261 checklist domains in 111 operations	Broad Surgical Speciality
Montgomery et al., 2016 [31]	114 observed at baseline 39 after the intervention	Pediatric Surgery
Mascherek et al., 2016 [32]	10 Swiss hospitals participated in QI program	Multiple Surgical Specialties
Martis et al., 2016 [33]	4760 specimens before intervention 5065 specimens after the change	General, Orthopaedics, Urology, Neurosurgery, Pediatric, Cardiothoracic, Otorhinolaryngology, Gynecology & Obstetrics
Dixon et al., 2015 [34]	40 patients	General, colorectal, Thoracic, Orthopedic, Gynecologic, and Surgical Oncology
Lilaonitkul et al., 2015 [35]	3341 operations	General Surgery

Table 2. *Extraction template summary of outcomes of the quality improvements.* "Mixed" represents results with some interventions that are effective but not others. Effective interventions demonstrated statistically significant improvements. Mixed interventions showed improvements in some outcomes while other parts of the intervention demonstrated either no improvement or produced worse outcomes.

Author/Publication Year	Outcome Types	Effectiveness
Campbell et al., 2024 [14]	Staff opinion, Simulation scoring rubric, Simulation Quality, Compliance, Engagement	Mixed
Krstulovic et al., 2025 [15]	Compliance	Effective
Badasa et al., 2025 [16]	Utilization	Effective
Bete et al., 2023 [17]	QI measures, SSC utilization	Effective
Levy et al., 2023 [18]	Participation/Engagement	Effective
Nofal et al., 2023 [11]	Compliance	Effective
Fridrich et al., 2022 [19]	Feedback characteristic	Effective
Brown et al., 2021 [20]	Compliance	Effective
Ngonzi et al., 2021 [21]	Compliance	Effective
Cushley et al., 2021 [22]	Compliance, Engagement, Online survey	Effective
Lagoo et al., 2019 [23]	Local Practice, Clinician and Representative Objective Opinion	Effective
Finch et al., 2019 [24]	Compliance Rate, Quality of Patient Outcome	Effective
Robertson et al., 2015 [25]	Compliance Rates	Effective
Overdyk et al., 2015 [26]	Compliance Rates	Mixed
Rhee et al., 2016 [27]	Audit Performance	Effective
Reed et al., 2016 [28]	Compliance	Mixed
Putnam et al., 2016 [29]	Compliance, Adherence Improvement	Mixed
Ong et al., 2015 [30]	Compliance	Effective
Montgomery et al., 2016 [31]	Compliance/ Staff engagement	Effective
Mascherek et al., 2016 [32]	Compliance	Effective
Martis et al., 2016 [33]	Compliance	Effective
Dixon et al., 2015 [34]	Compliance, Quality	Mixed
Lilaonitkul et al., 2015 [35]	Compliance rates	Effective

Discussion

Effectiveness of QII

The studies included in this review demonstrated that QII targeting the SSC are generally effective in improving checklist compliance, completeness, and staff engagement across diverse surgical settings. The interventions identified varied widely, ranging from single-component educational initiatives to multifaceted quality improvement programs incorporating audit and feedback, mentorship, simulation-based training, and the introduction of new or modified checklist tools.

The predominance of compliance as an outcome measure across the included studies reflects both its feasibility and its alignment with implementation focused research objectives [11, 14–15, 20, 22, 24–26, 28–35]. Compliance is relatively straightforward to measure through observation or audit and serves as an important indicator of whether the checklist is being used as intended. However, improvements in compliance alone do not reflect the quality of meaningfulness of checklist use, and several studies in this review acknowledged that checklist completion may become a ritual if not accompanied by active engagement and communication.

Although most studies reported improvements following intervention implementation, a subset demonstrated limited or non-significant effects. These outcomes may be explained by several factors, including high baseline compliance limiting measurable improvement, insufficient intervention intensity, or lack of sustained reinforcement. In some cases, interventions targeting specific pause points rather than the full checklist process may have constrained overall impact. Additionally, variations in study design and follow-up duration likely influenced the ability to detect significant changes.

Contextual and Organizational Factors Influencing Outcomes

The effectiveness of SSC-focused QII appears to be influenced by contextual and organizational factors, including the surgical specialty, institutional setting, and healthcare system characteristics. Interventions were implemented across a wide range of specialties, with several studies involving multiple surgical disciplines, while others focused on single specialties such as pediatrics or general surgery [16–17, 29, 31]. Differences in workflow complexity, team composition, and procedural variability across specialties may affect how the checklist is perceived and utilized, potentially contributing to variability in the effectiveness.

Human factors and workplace culture also emerge as important influences across the included studies.

Interventions that promoted interprofessional collaboration, psychological safety, and shared ownership of the checklist were more likely to report improvements in engagement, and perceived safety culture. Conversely, hierarchical team dynamics, resistance to change, and competing clinical demands undermined intervention effectiveness in some contexts. These findings align with broader patient safety literature emphasizing that technical tools such as checklist must be supported by a culture that values open communication and teamwork [14, 25, 30–31, 34].

Strengths and Limitations of the Evidence

The reviewed literature reflects a broad range of surgical specialties, included general surgery, obstetrics and gynecology, orthopedics, pediatrics, and subspecialty surgical fields, enhancing the relevance of the findings across diverse clinical contexts [11, 14–16, 21–24, 32–35]. Additionally, studies were conducted in a variety of healthcare settings, including academic medical centers, community hospitals, and public health facilities, indicating that SSC-focused QII can be adapted to different organizational environments [17, 27, 32].

Despite the generally positive findings, there are also several important limitations that should be considered. First, most included studies used observational, audit-based, or pre-post intervention designs, which are susceptible to bias and confounding [11, 18–19, 21, 26, 31, 33, 35]. Without randomized or controlled designs, it is difficult to attribute observed improvements solely to the interventions.

To add on, many of the outcomes relied on direct observation or self-reported measures of compliance, introducing the possibility of the Hawthorne effect. The awareness of being observed can artificially inflate the compliance rates, particularly in studies that involve peer observation, video auditing, or simulation-based assessments. This phenomenon can disproportionately affect studies that used direct observational methods, compared to those that use retrospective audits or administrative data. As a result, reported improvements in checklist adherence may partly reflect temporary behavioural changes, rather than a sustained change in practice. Furthermore, relatively few studies included long-term follow-up assessments to determine whether improvements persisted after active monitoring or invention periods ended. In studies where monitoring was reduced or discontinued, the sustainability of improvements remains uncertain, highlighting the importance of incorporating periodic audits, or feedback mechanisms to support durable implementation of the SSC.

Finally, the limited reporting of patient-level outcomes represents a critical gap in the literature. While improved compliance and engagement are important intermediate outcomes, they do not translate into reductions in surgical complications or mortality. Given the substantial global burden of postoperative morbidity and mortality, future studies should prioritize rigorous evaluation of clinical outcomes alongside process measures.

Implementation Barriers and Existing Literature

Several implementation barriers were evident across the studies, including time constraints, staff resistance, inconsistent leadership support, and variability in training uptake [36–37]. The reliance on observational or audit-based assessment methods also raises concerns regarding sustainability, as improvements observed during periods of active monitoring may not persist once oversight is reduced. These barriers highlight the challenges of translating checklist use into routine clinical practice, particularly in busy surgical environments.

The findings of this review are consistent with major studies and systematic reviews in surgical safety literature, which have demonstrated that the effectiveness of the SSC depends heavily on implementation quality rather than checklist adoption alone [36–37]. Multicenter studies initially reported reductions in postoperative complications and mortality following SSC introduction, however, subsequent research has shown more variable results, particularly when implementation is superficial or poorly integrated. More recent literature has emphasised the role of continuous quality improvement strategies, leadership engagement, and team-based interventions in achieving sustainable improvements [38].

By synthesizing a decade of QI-focused studies, this review contributes to the growing recognition that compliance metrics, while important, provide an incomplete picture of checklist effectiveness. Incorporating additional measures such as team communication, safety culture, and patient-centered outcomes may offer a more comprehensive understanding of how and why SSC interventions succeed or fail. Thus, future research should draw on implementation science frameworks to better account for contextual factors, identify key facilitators and barriers, and guide the design of interventions that are effective and sustainable.

Implications for Practice and Research

The findings of this review suggest that healthcare settings seeking to improve SSC implementation should prioritize multifaceted QI interventions that extend beyond checklist introduction. Interventions that promote active engagement, interprofessional communication, and continuous feedback are particularly effective. Importantly, QI strategies should be tailored to local context, considering baseline compliance, available resources, and organizational culture.

For future research, there's a clear need for more methodologically robust studies, including controlled or randomized designs, to better isolate the effects of the QII. Standardization of outcome definitions would facilitate comparison across studies and enable future meta-analyses. Additionally, longer follow-up periods are needed to assess

the sustainability of improvements and their impact on long-term patient outcomes.

Conclusions

This systematic review demonstrates that QII are effective in enhancing compliance, engagement, and qualitative aspects of SSC implementation across a wide range of surgical specialties and healthcare settings. Education initiatives, audit and feedback mechanisms, mentorship, and the introduction of new or modified checklist tools were consistently associated with improved checklist use and team participation. However, the existing evidence is constrained by methodological limitations, substantial heterogeneity, and a reliance on process-based outcomes rather than patient centered measures. Future research should prioritize standardized outcome reporting, rigorous study designs, and evaluation of clinical outcomes to better establish the impact of SSC focused QII on surgical safety and patient outcomes.

List of Abbreviations

HDI: Human Development Index
JBI: Joanna Briggs Institute
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QI: quality improvement
QII: quality improvement interventions
ROBVIS: Risk of Bias Visualization Tool
SSC: surgical safety checklist
WHO: World Health Organization

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Ethics Approval and/or Participant Consent

Ethics approval was not needed as this a review article and not directly involved in having human participants.

Authors' Contributions

EZ: made substantial contributions to the design of the study, the collection of data as well as interpretation and data analysis, revised the manuscript critically, and gave final approval of the version to be published.
LM: made substantial contributions to the design of the study, the collection of data as well as interpretation and data analysis, revised the manuscript critically, and gave final approval of the version to be published.

Acknowledgements

The authors extend their sincere gratitude to Arthur Tung (AT) for his exceptional guidance and oversight during the preparation of this manuscript. His expertise, contributions, and support were instrumental in enhancing its overall rigor and quality.

Funding

This study was not funded.

References

[1] Reddy C, Bains L, Kumar PK, Zadey S. Transforming surgical care and safety: Dissecting the impact of checklists in the global south. Front Surg. 2025 Nov 17;12:1664277. https://doi.org/10.3389/fsurg.2025.1664277
[2] Nepogodiev D, Martin J, Biccard B, Makupe A, Bhangu A. Global burden of postoperative death. The Lancet. 2019;393(10170):401. https://doi.org/10.1016/S0140-6736(18)33139-8
[3] Fabri PJ, Zayas-Castro JL. Human error, not communication and systems, underlies surgical complications. Surgery. 2008 Oct;144(4):557–65. https://www.doi.org/10.1016/j.surg.2008.06.011
[4] Ey JD, Kollias V, Lee O, Hou K, Herath MB, North JB, et al. Non-technical error leading to patient fatalities in the Australian surgical population. British Journal of Surgery. 2025 Mar 28;112(4):znaf083. https://www.doi.org/10.1093/bjs/znaf083
[5] World Health Organization. New checklist to help make surgery safer [Internet]. Geneva: World Health Organization. 2008 Jun. https://www.who.int/news/item/24-06-2008-new-checklist-to-help-make-surgery-safer
[6] Sivathasan N, Rakowski KRM, Robertson BFM, Vijayarajan L. The World Health Organization's "Surgical Safety Checklist": Should evidence-based initiatives be enforced in hospital policy? JRSM Short Reports. 2010 Oct;1(5):1–5. https://doi.org/10.1258/shorts.2010.010007
[7] Fudickar A, Hörle K, Wiltfang J, Bein B. The effect of the WHO surgical safety checklist on complication rate and communication. Deutsches Aerzteblatt International. 2012 Oct 19;109(42):695–701. https://www.doi.org/10.3238/arztebl.2012.0695
[8] Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AHS, Dellinger EP, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. New England Journal of Medicine. 2009 Jan 29;360(5):491–9. https://doi.org/10.1056/nejmsa0810119
[9] Urbach DR, Govindarajan A, Saskin R, Wilton AS, Baxter NN. Introduction of surgical safety checklists in Ontario, Canada. New England Journal of Medicine. 2014 Mar 13;370(11):1029–38. https://www.doi.org/10.1056/nejmsa1308261
[10] Pourzamani M, Shamloo B, Rashidi N, Kalani L, Keshvari S. Barriers to implementing the surgical safety checklist in operating rooms of educational hospitals of Dezful University of Medical Sciences: A qualitative study. Evidence Based Care. 2025 Apr;15(1):67–75. https://www.doi.org/10.22038/ebcj.2025.85514.3090

[11] Nofal MR, Starr N, Mammo TN, Trickey AW, Gebeyehu N, Koritsanszky L, et al. Addressing knowledge gaps in surgical safety checklist use: Statistical process control analysis of a surgical quality improvement programme in Ethiopia. British Journal of Surgery. 2023 Aug 8;110(11):1511–7. https://www.doi.org/10.1093/bjs/znad234

[12] Paterson C, Mckie AL, Turner M, Kaak V. Barriers and facilitators associated with the implementation of surgical safety checklists: A qualitative systematic review. Journal of Advanced Nursing. 2023 Sep 7;80(2):465–83. https://www.doi.org/10.1111/jan.15841

[13] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. British Medical Journal. 2021 Mar 29;372(8284):n71. https://www.doi.org/10.1136/bmj.n71

[14] Campbell KK, Abreu AA, Zeh HJ, Daniel WC, Palter VN, Bishop SJ, et al. Using OR black box technology to determine quality improvement outcomes for in-situ timeout and debrief simulation. Annals of Surgery. 2024 Jul 11;283(1):122–9. https://www.doi.org/10.1097/sla.0000000000006438

[15] Krstulović J, Hrgović Z, Krešo A, Tavra A, Znaor L, Marušić A. Interventions to improve compliance to surgical safety checklist use: Before-and-after study at a tertiary public hospital in Croatia. Healthcare. 2025 Aug 10;13(16):1959. https://www.doi.org/10.3390/healthcare13161959

[16] Badasa K, Abera M, Abebe M, Fikadu G, Beki M, Teshome M, et al. Improving utilisation of the WHO surgical safety checklist at Wollega University Referral Hospital: A multidimensional quality improvement project. BMJ Open Quality. 2025 May;14(2):e002599. https://www.doi.org/10.1136/bmjoq-2023-002599

[17] Bete DY, Sibhatu MK, Godebo MG, Abdulahi IJ, Liyew TW, Minas SM, et al. Improving surgical safety checklist utilisation at 23 public health facilities in Ethiopia: A collaborative quality improvement project. BMJ Open Quality. 2023 Nov 1;12(4):e002406–6. https://www.doi.org/10.1136/bmjoq-2023-002406

[18] Levy BE, Wilt WS, Lantz S, Ballert E, Harris A. Standardization and visualization of the surgical timeout. Journal of Patient Safety. 2023 Oct 1;19(7):453–9. https://www.doi.org/10.1097/pts.0000000000001156

[19] Fridrich A, Imhof A, Staender S, Brenni M, Schwappach D. A quality improvement initiative using peer audit and feedback to improve compliance with the surgical safety checklist. International Journal for Quality in Health Care. 2022 Jun 30;34(3):mzac058. https://www.doi.org/10.1093/intqhc/mzac058

[20] Brown B, Bermingham S, Vermeulen M, Jennings B, Adamek K, Markou M, et al. Surgical safety checklist audits may be misleading! Improving the implementation and adherence of the surgical safety checklist: A quality improvement project. BMJ Open Quality. 2021 Nov;10(4):e001593. https://www.doi.org/10.1136/bmjoq-2021-001593

[21] Ngonzi J, Bebell LM, Boatin AA, Owaraganise A, Tiibajuka L, Fajardo Y, et al. Impact of an educational intervention on WHO surgical safety checklist and pre-operative antibiotic use at a referral hospital in southwestern Uganda. International Journal for Quality in Health Care. 2021 Jan 1;33(3):mzab089. https://www.doi.org/10.1093/intqhc/mzab089

[22] Cushley C, Knight T, Murray H, Kidd L. Writing's on the wall: Improving the WHO surgical safety checklist. BMJ Open Quality. 2021 Jan;10(1):e001086. https://www.doi.org/10.1136/bmjoq-2020-001086

[23] Lagoo J, Singal R, Berry W, Gawande A, Lim C, Paibulsirijit S, et al. Development and feasibility testing of a device briefing tool and training to improve patient safety during introduction of new devices in operating rooms: Best practices and lessons learned. Journal of Surgical Research. 2019 Dec;244:579–86. https://www.doi.org/10.1016/j.jss.2019.05.056

[24] Finch EP, Langston M, Erickson D, Pereira K. Debriefing in the OR: A quality improvement project. AORN Journal. 2019 Feb 27;109(3):336–44. https://www.doi.org/10.1002/aorn.12616

[25] Robertson E, Morgan L, New S, Pickering S, Hadi M, Collins G, et al. Quality improvement in surgery combining lean improvement methods with teamwork training: A controlled before-after study. PLOS ONE. 2015 Sep 18;10(9):e0138490. https://www.doi.org/10.1371/journal.pone.0138490

[26] Overdyk FJ, Dowling O, Newman S, Glatt D, Chester M, Armellino D, et al. Remote video auditing with real-time feedback in an academic surgical suite improves safety and efficiency metrics: A cluster randomised study. BMJ Quality & Safety. 2015 Dec 11;25(12):947–53. https://www.doi.org/10.1136/bmjqs-2015-004226

[27] Rhee AJ, Valentin-Salgado Y, Eshak D, Feldman D, Kischak P, Reich DL, et al. Team training in the perioperative arena: A methodology for implementation and auditing behavior. American Journal of Medical Quality. 2016 Aug 10;32(4):369–75. https://www.doi.org/10.1177/1062860616662703

[28] Reed S, Ganyani R, King R, Pandit M. Does a novel method of delivering the safe surgical checklist improve compliance? A closed loop audit. International Journal of Surgery. 2016 Aug;32:99–108. https://www.doi.org/10.1016/j.ijsu.2016.06.035

[29] Putnam LR, Anderson KT, Diffley MB, Hildebrandt AA, Caldwell KM, Minzenmayer AN, et al. Meaningful use and good catches: More appropriate metrics for checklist effectiveness. Surger. 2016 Dec 1;160(6):1675–81. https://www.doi.org/10.1016/j.surg.2016.04.038

[30] Ong APC, Devcich DA, Hannam J, Lee T, Merry AF, Mitchell SJ. A "paperless" wall-mounted surgical safety checklist with migrated leadership can improve compliance and team engagement. BMJ Quality & Safety. 2015 Dec 30;25(12):971–6. https://www.doi.org/10.1136/bmjqs-2015-004545

[31] Montgomery K, Khan I, Thomson K, Wynne D. Improving the practice of the World Health Organisation's surgical pause checklist at a tertiary paediatric surgical unit. Scottish Medical Journal. 2016 May;61(2):88–91. https://www.doi.org/10.1177/0036933016649873

[32] Mascherek AC, Bezzola P, Gehring K, Schwappach DLB. Effect of a two-year national quality improvement program on surgical checklist implementation. Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen. 2016;114:39–47. https://www.doi.org/10.1016/j.zefq.2016.04.003

[33] Martis WR, Hannam JA, Lee T, Merry AF, Mitchell SJ. Improved compliance with the World Health Organization surgical safety checklist is associated with reduced surgical specimen labelling errors. The New Zealand Medical Journal. 2016 Sep 9;129(1441):63–7. https://pubmed.ncbi.nlm.nih.gov/27607086

[34] Dixon JL, Mukhopadhyay D, Hunt J, Jupiter D, Smythe WR, Papaconstantinou HT. Enhancing surgical safety using digital multimedia technology. The American Journal of Surgery. 2016 Jun 1;211(6):1095–8. https://www.doi.org/10.1016/j.amjsurg.2015.08.023

[35] Lilaonitkul M, Kwikiriza A, Ttendo S, Kiwanuka J, Munyarungero E, Walker IA, et al. Implementation of the WHO surgical safety checklist and surgical swab and instrument counts at a regional referral hospital in Uganda – A quality improvement project. Anaesthesia. 2015 Nov 11;70(12):1345–55. https://www.doi.org/10.1111/anae.13226

[36] Lim PL, Lin CY, Siow S, Hoon LS. Facilitators and barriers to the implementation of surgical safety checklist (SSC): An integrative review. International Journal for Quality in Health Care. 2023 Oct 1;35(4):mzad086. https://www.doi.org/10.1093/intqhc/mzad086

[37] Bergs J, Lambrechts F, Simons P, Vlayen A, Marneffe W, Hellings J, et al. Barriers and facilitators related to the implementation of surgical safety checklists: A systematic review of the qualitative evidence. BMJ Quality & Safety. 2015 Jul 21;24(12):776–86. https://www.doi.org/10.1136/bmjqs-2015-004021

[38] Turley N, Elam M, Brindle ME. International perspectives on modifications to the surgical safety checklist. JAMA Network Open. 2023 Jun 7;6(6):e2317183–3. https://www.doi.org/10.1001/jamanetworkopen.2023.17183

Article Information
Managing Editor: Jeremy Y. Ng
Peer Reviewers: Arthur Tung, Farhan Khandakar
Article Dates: Received Dec 31 25; Accepted Mar 20 26; Published May 22 26

Citation
Please cite this article as follows:
Manger LK, Zhang E. Systematic review of quality improvement interventions on surgical safety checklists. URNCST Journal. 2026 May 22: 10(5). https://urncst.com/index.php/urncst/article/view/1047
DOI Link: https://doi.org/10.26685/urncst.1047